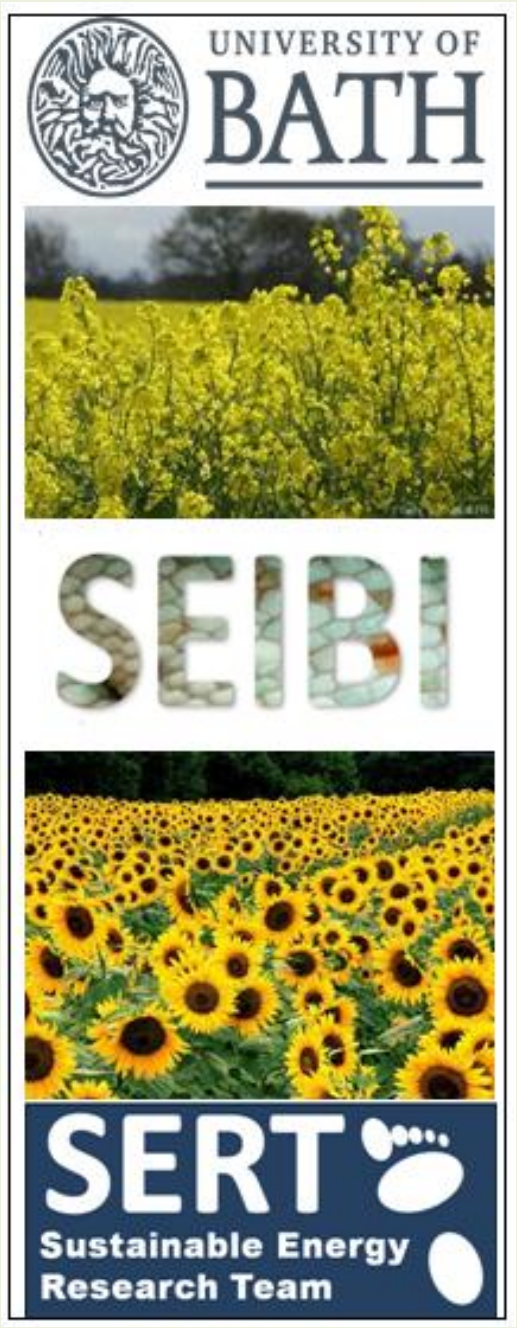

SETAC Europe 18th LCA Case study Symposium:

Copenhagen, 26 – 28 November 2012.

Carbon Foot-print Analysis and Life Cycle Assessment of Mayonnaise production.

A comparison of their results and messages.

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2. University of Nottingham, Division of Food Sciences, Sutton Bonington Campus, Loughborough, U.K.

Background to the project

Sustainable Emulsion Ingredients through Bio-Innovation (SEIBI) project is a U.K Defra funded multidisciplinary project:

- Universities of Bath and Nottingham
- PepsiCo, Croda, Eminate.

SEIBI project was initiated to investigate novel processing routes for the production of edible oil emulsions for food production.

- *Analysis of mayonnaise as an emulsion product has been performed*
- *No existing literature identified outlining the environmental impacts related to mayonnaise processing*

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Objectives of the paper / Research Questions

To perform a 'cradle to gate' Carbon Footprint Analysis (CFA) and standard Life Cycle Assessment (LCA) of rapeseed oil based mayonnaise to obtain environmental performance data and enable comparisons between the results obtained.

The analysis was aimed at answering the following questions:

- *What is the 'cradle to gate' Carbon Foot-print of rapeseed oil based mayonnaise?*
- *How significant is Climate Change as an impact category when compared with the wider range of impacts?*
- *Do the CFA and LCA yield consistent results with regards to the largest contributors within the system?*

Methodology used

Attributional LCA models were constructed using SimaPro 7.3.2:

Functional Unit:

1 tonne of rapeseed-oil mayonnaise produced in UK, packaged in 600g jars, palletised and ready for distribution

Starting boundary:

Cultivation of crop

Finishing boundary:

Mayonnaise packaging facility

Data sources:

Peer reviewed literature & proprietary databases available within SimaPro

LCIA:

ReCiPe(2008), Midpoint & Endpoint

IPCC(2007)

	Conventional Mayonnaise % input
Reference	Meeuse et al. 2000
Rapeseed Oil	80
Egg yolk	8
Water	7
Vinegar	3
Salt	1
Sugar	1

Rapeseed oil	
Cultivation	Germany
Extraction	Germany
Refining	Netherlands
Transport farm to mill	Road 65km
Transport mill to refiner	Road 650 km
Transport refiner to factory	Road 150 km

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CARBON FOOT-PRINT

- Quantification of ‘cradle to gate’ Carbon Footprint of mayonnaise
- Relative contribution of individual process components.

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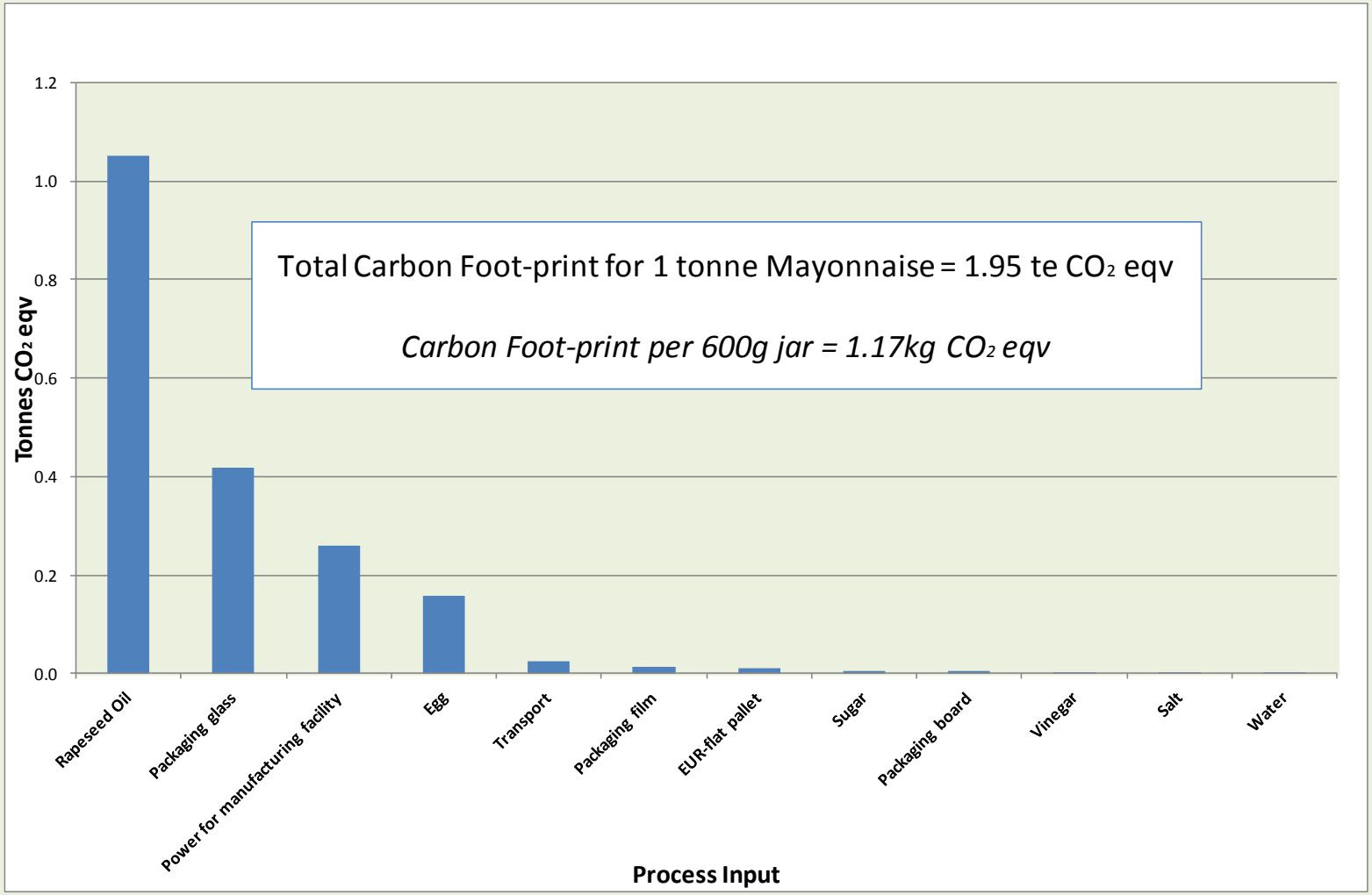
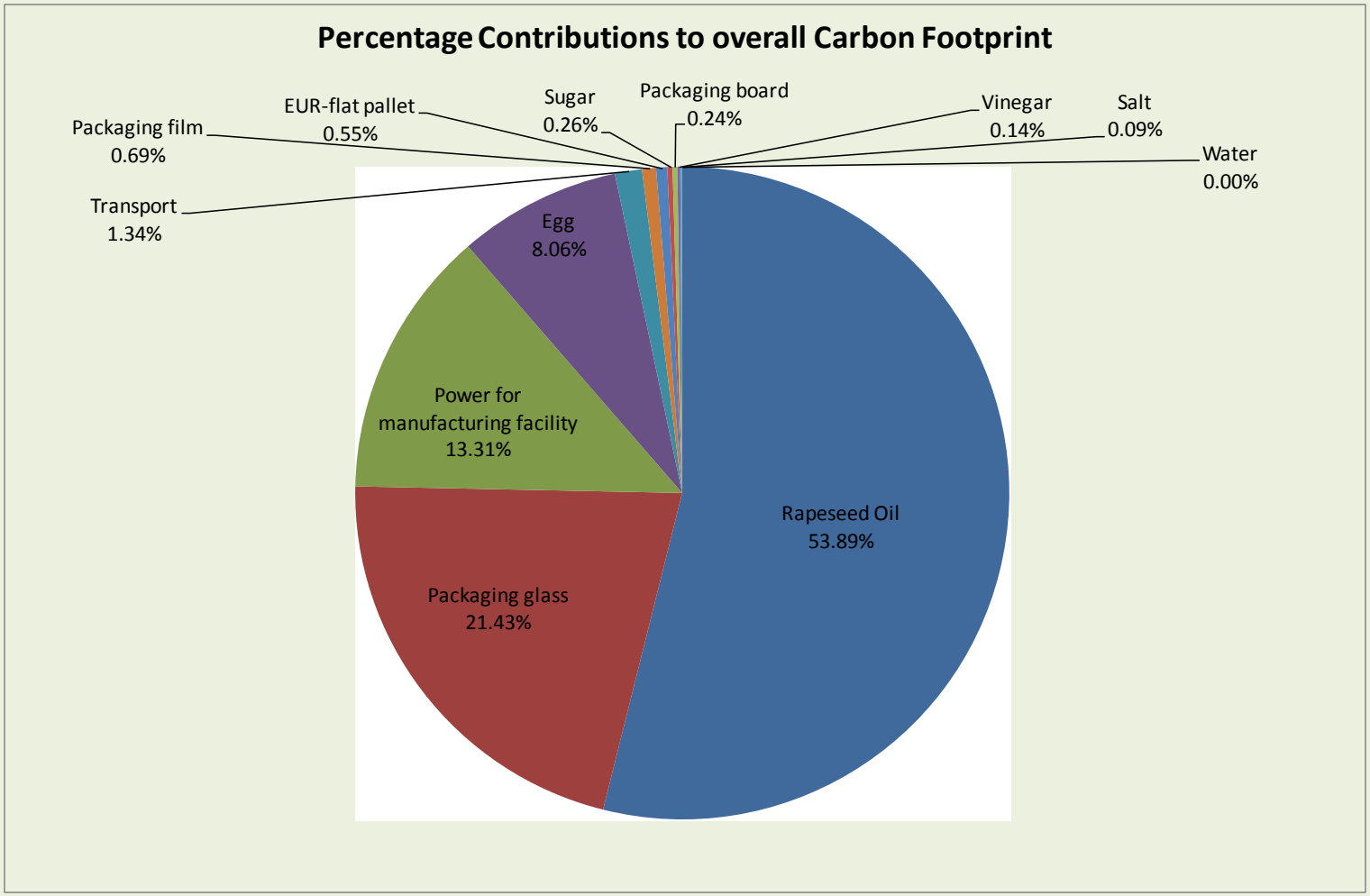
Cradle to Gate Carbon Footprint - Mayonnaise



Contribution of Process Components:

Mayonnaise Carbon Foot-print



LIFE CYCLE ASSESSMENT

All impact analysis performed using ReCiPe (2008)

- Overview of impact - Endpoint analysis
- Overview of impact - Midpoint analysis
- Relative contribution of individual process components.

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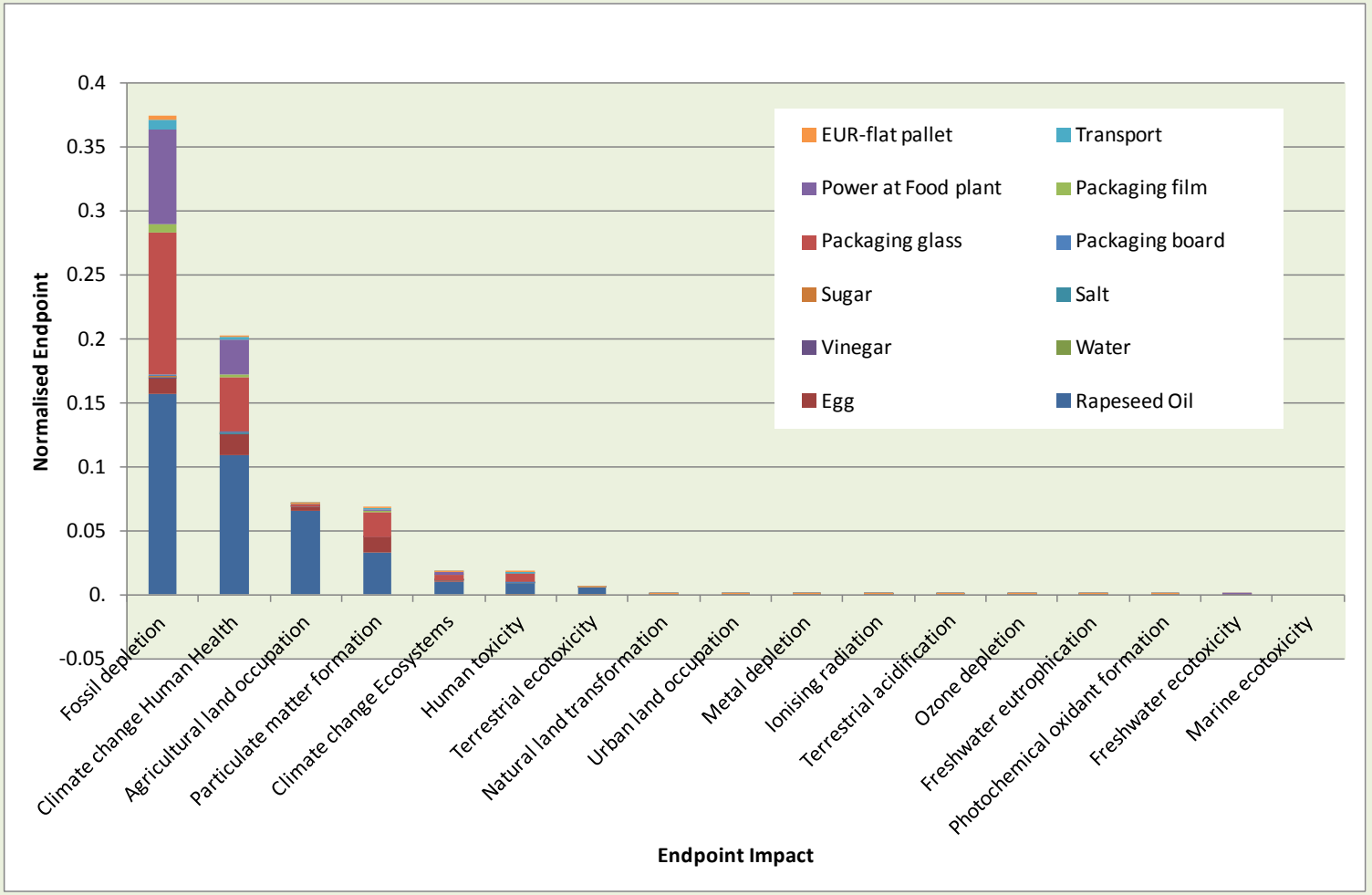
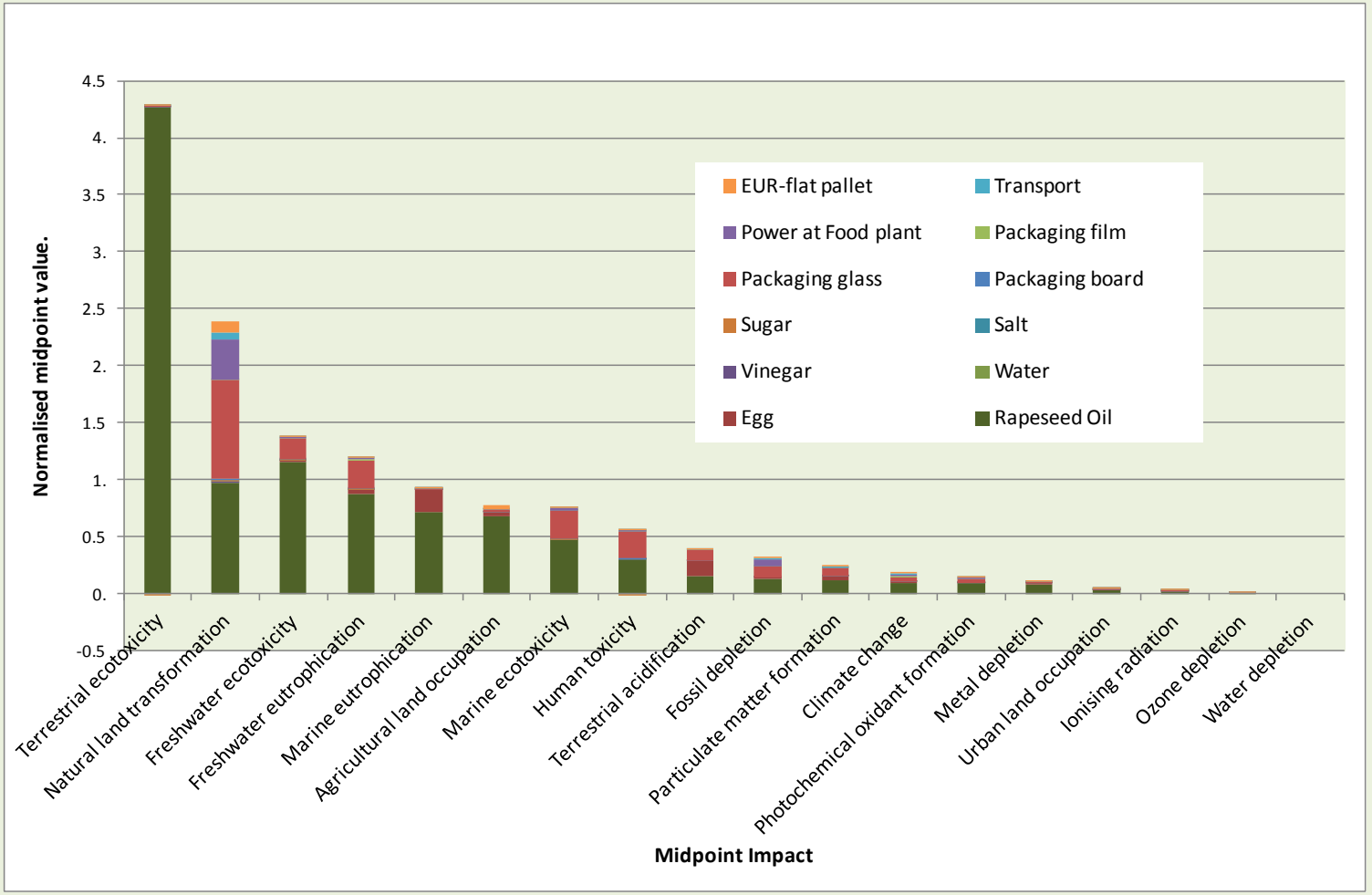
Life Cycle Impact Assessment using ReCiPe(2008): Normalised Endpoint data

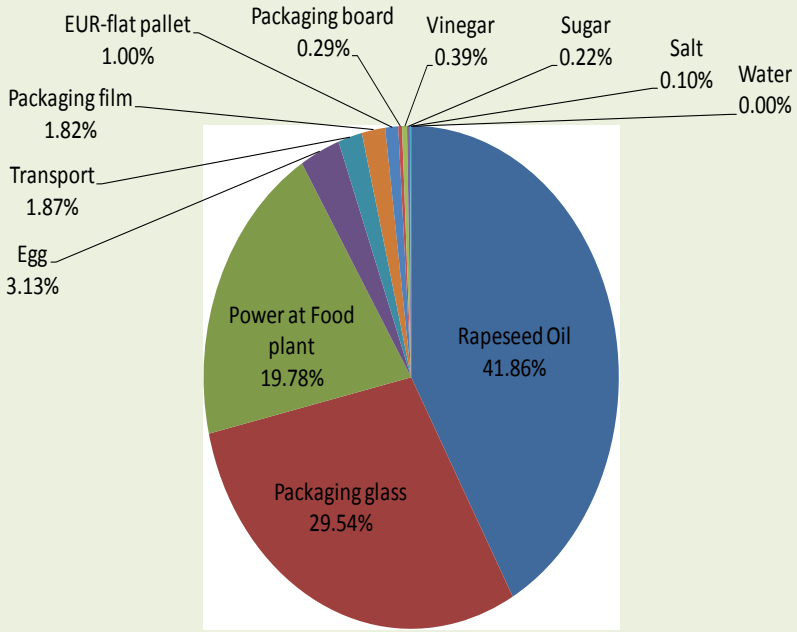


Life Cycle Impact Assessment using ReCiPe(2008): Normalised Midpoint data

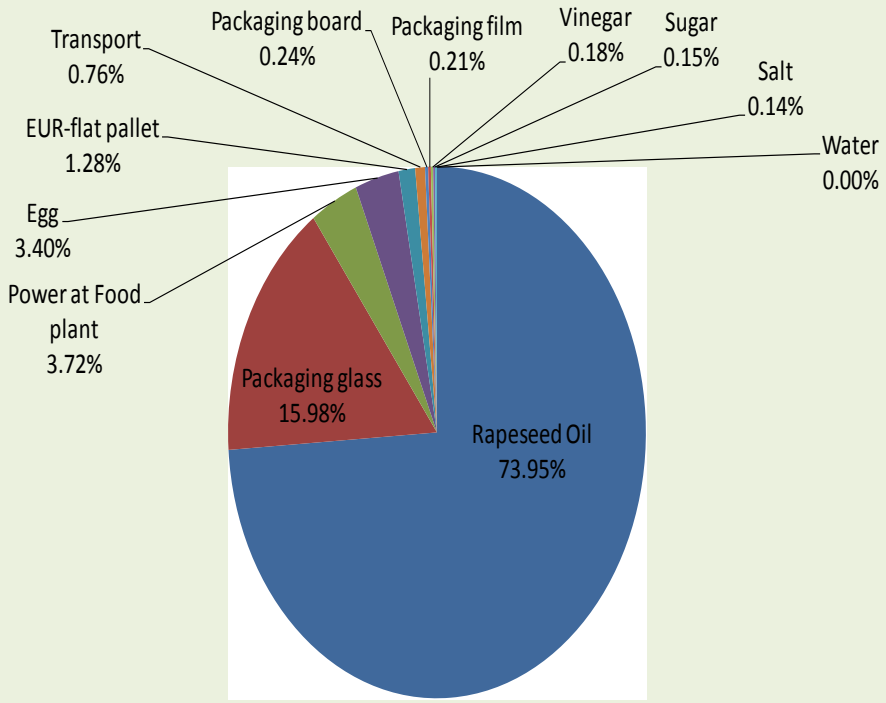


Contribution of Process Components within LCA:

LCA Endpoint analysis.



LCA Midpoint analysis.



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Conclusions

Carbon Foot-printing:

- The 'cradle to gate' Carbon Foot-print of 1 tonne of rapeseed oil mayonnaise is 1.95 te CO_2eqv. This equates to 1.17 kg CO_2eqv. per 600g jar
- The relative contributions based on CFA indicate that the rapeseed oil generates the greatest burdens within the system, followed by glass, power consumption at food plant and egg.

Life Cycle Assessment:

- Within a LCA of the same system, Climate Change is not indicated as the most significant impact category. It is 2nd when assessed using endpoints and 12th when assessed using midpoints
- The relative contributions based on LCA vary greatly dependant on whether mid or endpoints are used
- Both endpoint and midpoint analyses support the findings of the CFA that rapeseed oil generates the greatest burdens within the system, followed by glass, power consumption at food plant and egg.

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Further work :-

- Fully investigate rationale for large differences within midpoint and endpoint data
- Identify which is the most appropriate impact assessment method to use for ongoing performance analysis
- Introduce aggregate cultivation and transport data set for oil to represent multi sourcing of oil
- Compare conventional mayonnaise with that produced using novel process route for oil emulsion

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Thank you.

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- http://www.bath.ac.uk/mech-eng/sert/

Questions?

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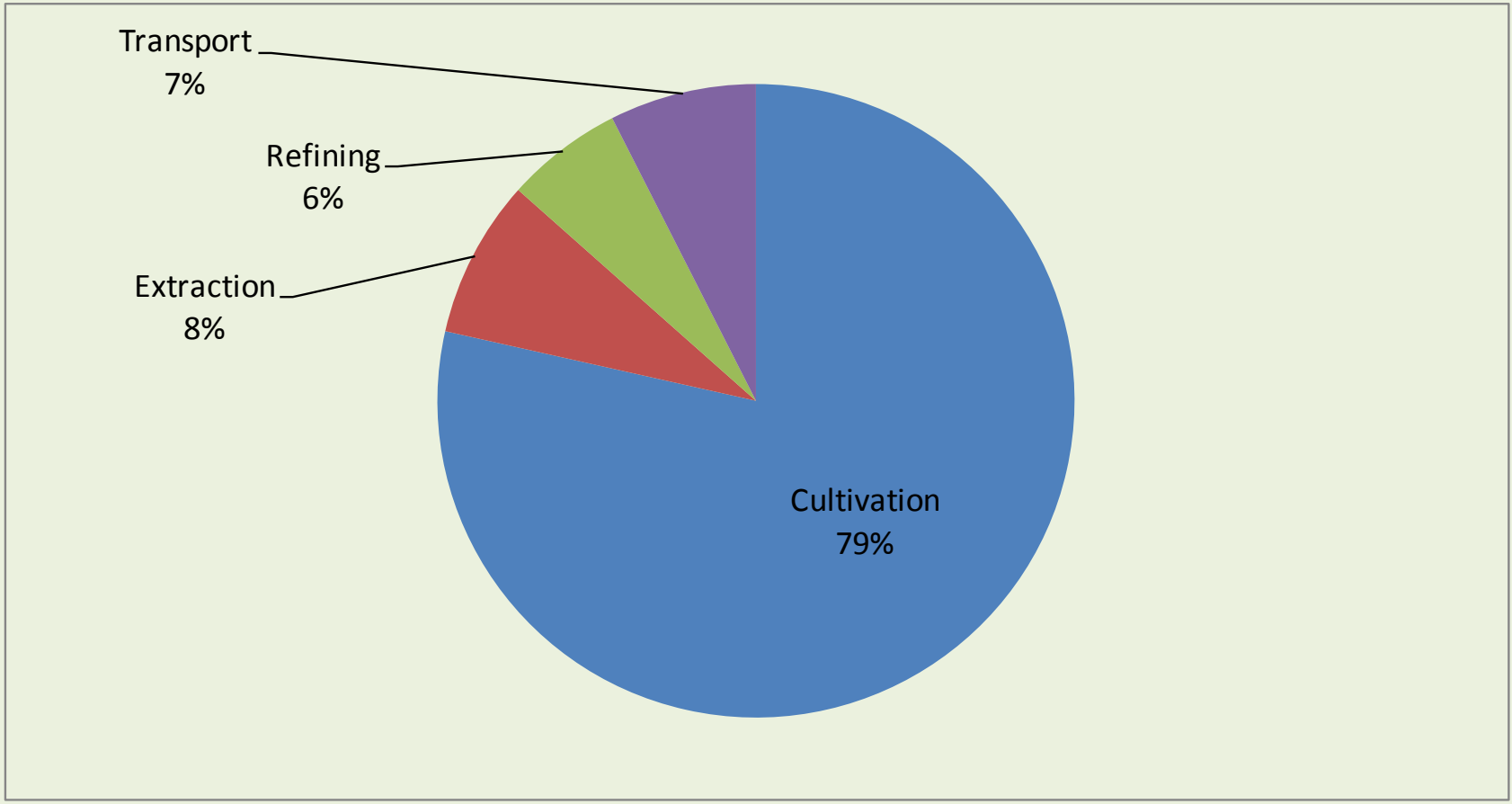
Rapeseed oil: Saxony cultivation
Breakdown of process stages for Carbon Foot-print



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